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भाग 6 झूले

Indian Standard

PLAYGROUND EQUIPMENT FOR PARK — SPECIFICATION

PART 6 SWINGS

ICS 97.220.30

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

July 2002

Price Group 6

Sports Goods Sectional Committee, PCD 22

FOREWORD

This Indian Standard (Part 6) was adopted by the Bureau of Indian Standards, after the draft finalized by the Sports Goods Sectional Committee had been approved by the Petroleum, Coal and Related Products Division Council.

Among the playground equipment installed in parks, swing is one of the popular equipment which is used by both children and adults. As the equipment is mostly used by children, a need was felt to formulate a specification on swing to primarily cover the safety aspects.

This part of IS 6869 does not specify particular materials but care should be exercised in selecting only materials of known quality properties of strength and durability.

Experience of equipment under known use is reliable basis for design, therefore, detailed design rules have not been included.

Purchasers of equipment manufactured in accordance with this specification will be assured that every attempt has been made to reduce potential hazards to a practical minimum even when children use the equipment in an unconventional manner. That assurance cannot be given if a child deliberately attempts to defeat a safety precaution. Recommendations on the design and sitting of swings and its barriers are given in Annex A for guidance.

In preparing this standard, assistance has been derived from BS 5696 Playground equipment, Part 1:1997 General safety requirements and test methods; BS 5696 Play equipment intended for permanent installation outdoors, Part 2 Specification for construction and performance; and Part 3 Code of practice for installation and maintenance. Reference has also been made to BS prEN 1176-2:1996 'Playground equipment, Part 2 Additional specific safety requirements and test methods for swings' and an International document ISO/DIS 8124 (Part 4) Swings, slides and similar toys for indoor and outdoor domestic use.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2:1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

PLAYGROUND EQUIPMENT FOR PARK – SPECIFICATION

PART 6 SWINGS

1 SCOPE

This standard prescribes the construction details, dimensions, requirements and methods of test for swings installed in parks as playground equipment.

2 REFERENCES

The following standards contain provisions, which through reference in this text constitute the provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below:

IS No.	*Title*
IS 1239 (Part 1) : 1990	Mild steel tubes, tubulars and other wrought steel fittings: Part 1 Mild steel tubes (*fifth revision*)
IS 1363 (Part 1) : 1992	Hexagon head bolts, screws and nuts of product grade C : Part 1 Hexagon head bolts (size range M5 to M64) (*third revision*)
(Part 2) : 1992	Hexagon head screws (size range M5 to M64) (*third revision*)
(Part 3) : 1992	Hexagon nuts (size range M5 to M64) (*third revision*)
IS 2429 (Part 1) : 1987	Round steel short link chain (electric butt welded), Grade L(3) : Part 1 Non-calibrated load chains for lifting purposes (*third revision*)
IS 3109 (Part 2) : 1982	Short link chain, Grade M(4) : Part 2 Calibrated load chain for pulley blocks and other lifting appliances (*second revision*)
IS 6869 (Part 1) : 1973	Playground equipment for parks : Part 1 General requirements

3 TERMINOLOGY

For the purpose of this standard, the following definitions shall apply.

3.1 Swinging Equipment

Swinging may be divided into single axis of motion and multiple axis of motion. A single axis swing is intended to swing back and forth in a single plane. A multiple axis swing consists of a swing suspended from a single pivot that permits it to swing in any direction.

3.2 Accessible Part

Any part of the equipment that in use may be contacted by any part of a child's body.

3.3 Component Parts

3.3.1 *Permanent Components*

Components designed to last the life of the equipment.

3.3.2 *Consumable Components*

Components subjected to wear and designed to be renewed several times during the life of the equipment.

3.3.3 *Replaceable Components*

Permanent or consumable components that may, if necessary, be replaced *in situ.*

3.4 Permanent Installation

Placing (of equipment) in or on foundations in the play area in such a way that the supporting, structural members cannot be moved without the use of mechanical aids.

NOTE — Supporting, structural members (and, therefore, the complete item of equipment) can be removed only if:

a) the foundations are broken up (where members are embedded in concrete); or

b) ground fastenings are removed (where members are clamped by means of base plates to bolts, or other devices, partially embedded in concrete); or

c) free-standing equipment is so heavy that mechanical assistance (e.g. mobile crane) is required to move it.

3.5 Rotating Equipment

Moving equipment with user supports that rotate about a central axis.

3.6 Moving Equipment

Equipment that contains moving part(s).

3.7 Static Equipment

Equipment that contains no moving part(s).

3.8 Swinging Equipment

Moving equipment with suspended supports or seats that allows the user to move backwards and forwards in a continuous arc on either side of the rest position.

3.9 Potential Entrapment

Any space between two parts that permits entry of any test probe but has the potential to resist its removal.

3.10 Wedge Trap

Any trap formed by an acute angle between two or more adjacent parts that converge in a downward direction.

4 CONSTRUCTION

4.1 Supports

Foundations for equipment should be prepared in accordance with the manufacturer's recommendation. Particular attention is necessary during preparation of foundations to ensure that final erection, especially where steel tube supports [*see* IS 1239 (Part 1)] will be embedded in concrete, can be carried out to the correct levels.

Particular attention is also necessary in the selection of appropriate size and strength of chains [*see* IS 2429 (Part 1) and IS 3109 (Part 2)] to safeguard the safety of the user which allows the movement backwards and forwards.

Swing should be suspended from support structures that discourage climbing. A-frame support structure should not have horizontal cross-bars.

4.2 Fastenings

Fastenings used in any accessible part of the equipment shall be of round headed type or hexagon type with chamfered corners unless countersunk or counterbored to eliminate sharp protrusions.

Accessible nuts shall have the projecting screw thread cut off and the remainder peened so that no sharp edges remain. Nuts, bolts and screws [*see* IS 1363 (Part 1), IS 1363 (Part 2) and IS 1363 (Part 3)] shall be secured against loosening. S-hooks shall be pinched and closed as tightly as possible.

4.3 Profiles and Exposed Surfaces

Component parts shall not have any rough or sharp edges or projections in any position that present a hazard to a child.

4.4 Seats

Each seating position shall be constructed for use by one child only.

a) The top of the seat shall be checkered (non-skid) type;

b) The clamps or clamp fasteners shall not project from the top surface of the seat;

c) The ground clearance from the seating surface loaded to 110 kg shall not be less than 455 mm and not more than 635 mm for open seats and not less than 455 mm and not more than 525 mm for cradle seats; and

d) The lowest part of seat shall not be less than 350 mm from the ground level.

4.5 Finish

4.5.1 *General*

The surfaces of all parts, not naturally resistant to corrosion or deterioration shall be protected by surface coating or impregnation.

4.5.2 *Iron and Steel*

Prior to painting, iron and steel shall be thoroughly clean, dry and free from welding slag, rust, scale and grease.

NOTES

1 *Corrosion* — Consideration may be given to the following aspects of design in order, as far as possible, to avoid corrosion of component parts of the equipment:

a) by sealing hollow sections to prevent the ingress of water or alternatively by making provision for water to drain away;

b) by designing joints and connections so that they are ventilated, self-draining or sealed to prevent the ingress of water by capillary or other means; and

c) by avoiding connections between dissimilar metals widely separated in the electrochemical series to prevent bimetallic corrosion.

2 Painting need not be applied when other forms of protection are used.

5 DIMENSIONS

5.1 Height

On complete assembly and foundation of equipment, the total height of the top bar shall not be more than 2 450 mm.

5.2 Length

5.2.1 The length of the top bar should be such that the seats with user shall not collide with each other or with the adjacent member under normal use while deviating from a simple arc in a vertical plane. Procedure to verify the same shall be as given in **5.2.2**.

5.2.2 Apply a load not less than 110 kg to the swing seat. Measure the length, *L*, of the seat in its laden condition. At a right angle to the plane of motion, apply a horizontal load of 12 kg to one edge of the seat as close as possible to the surface normally occupied by the user and measure the deflection from the equilibrium position. Repeat the procedure applying the load in the opposite direction.

5.2.3 A swing seat shall be considered to have passed the test if the maximum deviation (*t*) on application of horizontal load of 12 kg shall not be more than *L*/2 that is half the length of the seat (*see* Fig. 1). The clearance (*S*) in the equilibrium position between the adjacent seats or seat assemblies (side-by-side) shall not be less than 2 *t* + 100 mm and the clearance (*C*) between a seat or seat assembly and the adjacent structure shall not be less than t + 100 mm (*see* Fig. 1).

5.3 Workmanship and Finish

Swing shall conform to the requirements prescribed in **3** of IS 6869 (Part 1).

6 PERFORMANCE TESTS

6.1 Load Test

The equipment shall be subjected to load test by the method prescribed in Annex B. The equipment shall be considered to have passed the test provided it shows no cracks, permanent deformation or damage and no connection is loosened.

6.2 Safety Tests

6.2.1 *Test for Finger, Hand, Limb and Head Traps*

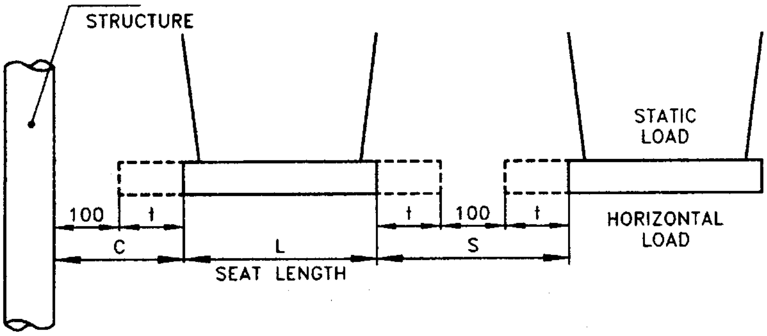
The equipment shall be subjected to finger, hand, limb and head traps test by the method prescribed in Annex C.

a) For parts other than chains supporting swing seats, the finger probe shall not enter the opening or position; or

b) If the finger probe does enter it shall enter to its full depth of 100 mm and shall not touch any part that can form a potential entrapment or crushing hazard during use of the equipment; or

c) If the hand probe enters it shall enter to its full depth of 165 mm and shall not touch any part that can form a potential entrapment or crushing hazard during use of the equipment and the limb probe shall not enter; or

d) If the limb probe enters, it shall enter to its full depth of 800 mm and shall not touch any part that can form a potential entrapment or crushing hazard during use of the equipment when moved to any accessible position that



All dimensions in millimetres.

FIG. 1 DEVIATION OF A TYPICAL SWING SEAT IN A LATERAL DIRECTION

can be reached by moving the probe about and the head probe A shall not enter; or

e) If head probe A enters, head probe B shall also enter and not touch any part that can form a potential entrapment or crushing hazard during use of the equipment; the head probes shall be capable of being withdrawn after rotating them through 90o.

NOTE — The criteria for equipment passing or failing the tests are shown diagrammatically in the chart given in Annex D.

6.2.2 *Deviation of Swing Seats in a Lateral Direction for Swings with more than One Point of Suspension*

When tested by the method prescribed in Annex E, swing seats shall have a deviation *t* from the equilibrium position, on the specified load, not exceeding *L*/2. In the equilibrium position the clearance *s* between adjacent seat or seat assemblies (side-by-side) shall be not less than 2*t* + 100 mm, and the clearance *c* between a seat or seat assembly and the adjacent structure shall be not less than *t* + 100 mm, where the symbols are as shown in Fig. 2.

6.3 Impact Testing of Swing Seats

When tested in accordance with procedure given in Annex F, there shall be no peak values of acceleration greater than 50 g

6.4 Dynamic Load Test for Swing Equipment

When tested in accordance with procedure given in Annex G, the consumable components in the suspension system (such as bearings, hooks, eyes and chains) shall show no cracks, permanant deformation or damage and no connection shall have been loosened. Additionally, there shall be no dimensional change in the components that can be seen with normal vision (aided by glasses or contact lenses where these are normally worn).

7 SURFACING MATERIALS

7.1 When choosing a surfacing material the following performance requirements should be considered:

a) Durability and stability,

b) Shock absorbancy,

c) Non-abrasiveness of finished surface,

d) Wet and dry slip resistance,

e) Ease of laying and maintenance,

f) Vandal resistance, and

g) Low water retention

7.2 It is strongly recommended that impact absorbing surfaces be provided in at least the operating area (*see* Fig. 3) around equipment, particularly those items from which falls are possible. Manufacturers will be able to provide recommendations for the minimum surface areas needing such protection. Such surfacing materials may be natural or manufactured. Particular attention is necessary to the proper installation of such surfaces since, if they are not properly installed, some may introduce new hazards such as tripping.

8 INSTALLATION

The manufacturer shall supply installation instructions which shall include sizes and other details for foundations, erection sequence, tightening for all bolts and similar items, and a check list against which correct assembly and operation can be assessed.

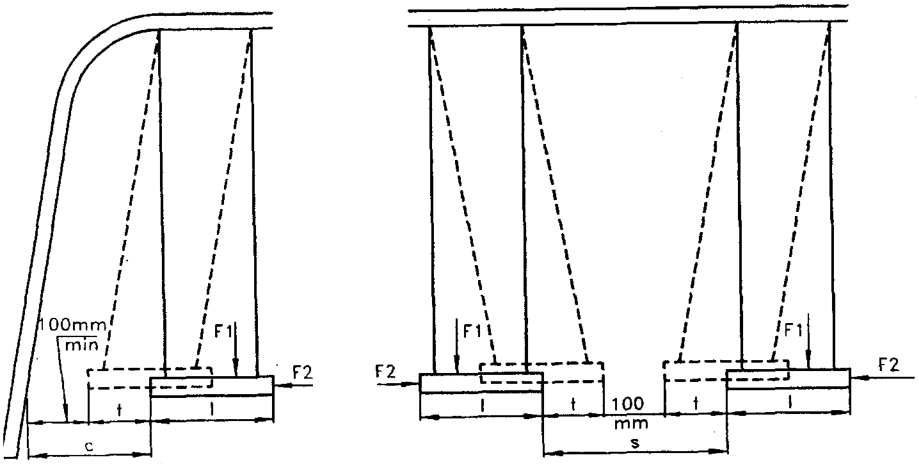


FIG. 2 DEVIATION OF A TYPICAL SWING SEAT IN A LATERAL DIRECTION

9 MAINTENANCE

It shall conform to **5** of IS 6869 (Part 1).

9.1 Ground Clearance

9.1.1 The swing shall have minimum clear space all around as shown in Fig. 3.

9.1.2 The shaded portion in the diagram is the highest potential impact area and shall be absolutely free of any obstruction movement.

9.2 Instruction for Use

The equipment shall be used for the sole purpose for which it is intended. Vandalism is to be restricted by the purchaser of the equipment.

10 PACKING AND MARKING

10.1 Packing

The equipment shall be packed for delivery as agreed to between the purchaser and the supplier.

10.2 Marking

Swing shall be durably marked with the following particulars in a visible location when erected on site:

a) Indication of the source of manufacture;

b) Month and year of manufacture; and

c) Batch or serial number.

10.3 BIS Certification Marking

The swing may also be marked with the Standard Mark.

10.3.1 The use of the Standard Mark is governed by the provisions of *Bureau of Indian Standards Act*, 1986 and the Rules and Regulations made thereunder. The details of conditions under which the licence for the use of Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

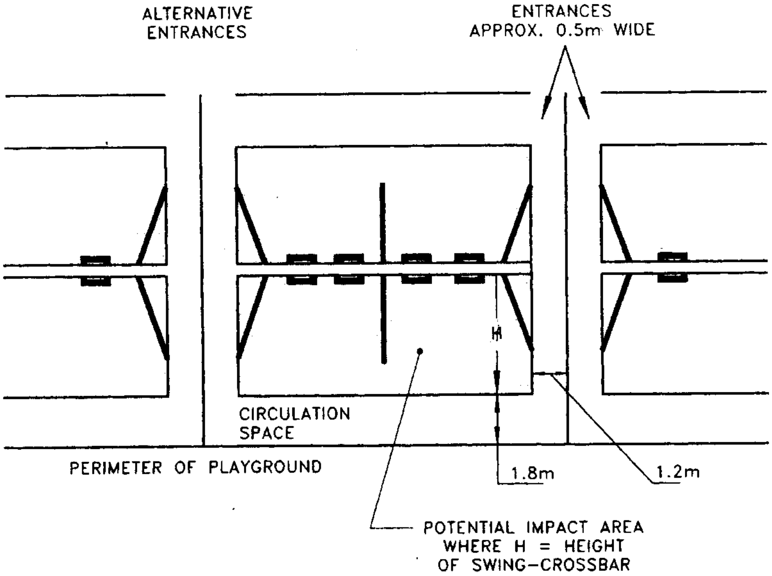

ALTERNATIVE ENTRANCES
ENTRANCES APPROX. 0.5m WIDE
H
CIRCULATION SPACE
PERIMETER OF PLAYGROUND
1.8m
1.2m
POTENTIAL IMPACT AREA WHERE H = HEIGHT OF SWING-CROSSBAR

FIG. 3 PLAN SHOWING SUGGESTED ARRANGEMENTS OF SWINGS BARRIERS

ANNEX A

(*Foreword*)

RECOMMENDATIONS FOR DESIGN AND SITTING OF SWINGS AND ITS BARRIERS

A-1 Swings designed specifically for use by younger children should be separated from those intended for older age groups. It is strongly recommended that 'toddlers' and 'junior' seats should not be mixed on the same multiple unit.

A-2 To discourage children from running into the path of moving swings, safety barriers should be provided as an enclosure to groups of swings. These barriers should be designed to discourage their use as gymnastic apparatus, and to prevent unintended access.

A-3 It is recommended that swings should be placed in enclosures at the perimeter of a playground to encourage children to face towards the remainder of the site. Each enclosure should have one or more entrances in corners of the enclosure nearer the centre of the playground to discourage children from waiting or moving behind the swings. Entrances should be designed so as to restrict the speed of entry (*see* Fig. 3).

"Swings should not be placed adjacent to sand".

Attaching single axis swings to composite structure is not recommended

ANNEX B

(*Clause* 6.1)

LOAD TEST

B-1 PRINCIPLE

Load testing assesses whether the strength of the equipment is capable of withstanding the load levels expected in normal use and the occasional heavier loading that can arise due to misuse by adults.

B-2 PROCEDURE

Apply simultaneously to the equipment static test loads of 230 kg on each swing seat and 100 kg horizontally at 90° to the cross bar centrally above each seating position. Maintain the loading for a period of 15 minutes. Remove the loads and inspect the equipment visually for signs of damage.

NOTE — For safety reasons, weights should be hung on the equipment wherever possible rather than placed on it where they may become dislodged.

ANNEX C

(*Clause* 6.2.1)

SAFETY TESTS

C-1 PRINCIPLE

Finger, hand, limb and head trap tests assess whether there are any features of construction that allow a child's finger, hand, limb or head to become trapped when the equipment is stationary or in use.

C-2 TEST PROBES

The dimensions of the test probes shall be as shown in Fig. 4. Application of probes to wedge traps is shown in Fig. 5.

NOTE — The probes may be manufactured from any suitable rigid material.

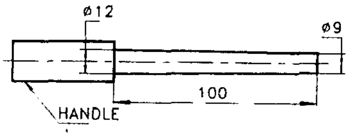
C-3 PROCEDURE

C-3.1 All Equipment

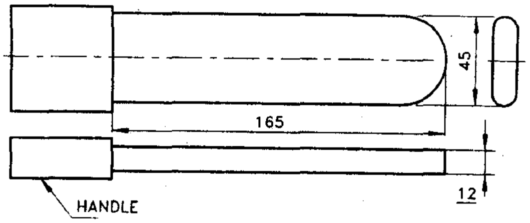
In all cases other than the means of access to equipment, apply the probes to both static equipment and to moving equipment in its stationary equilibrium position. Apply the probes in every accessible position and in any possible orientation that is likely to be reached by a child during use of the equipment and that can present a potential entrapment or crushing hazard. Start with the finger, hand or limb probe as appropriate for the size of opening or position concerned. Rotate the head probes through 90° before trying to withdraw them. Record which probes enter or do not enter, also whether those that enter can touch any parts that are likely to form a potential entrapment or crushing hazard.

C-3.2 Additional Procedure for Moving Equipment

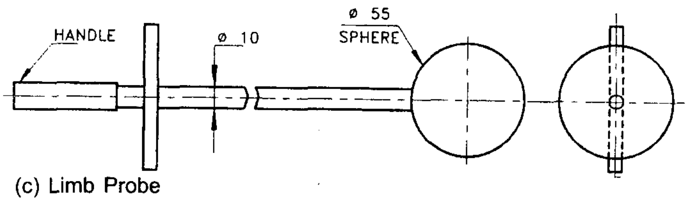
Set the equipment in motion and visually inspect throughout its range of motion recording all positions of the equipment at which any part normally accessible, or any parts becoming exposed and likely to be reached by a child during use of the equipment, form a potential



(a) Finger Probe



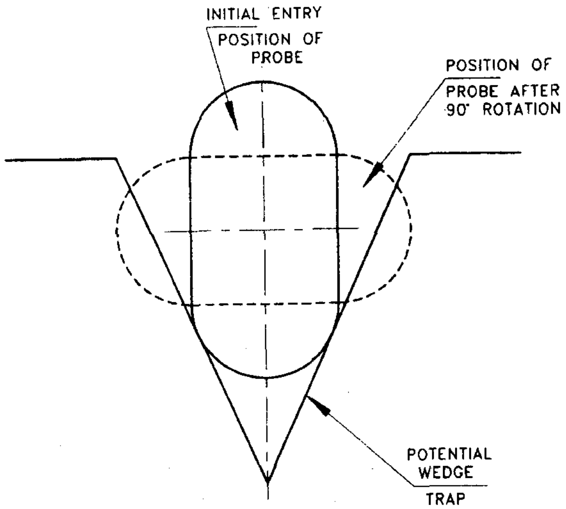
(b) Hand Probe



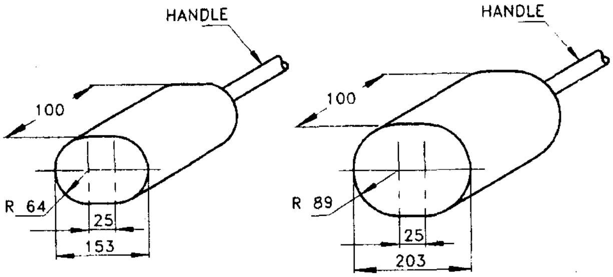
(c) Limb Probe

All dimensions in millimetres.

FIG. 4 TEST PROBES


INITIAL ENTRY POSITION OF PROBE
POSITION OF PROBE AFTER 90° ROTATION
POTENTIAL WEDGE TRAP

OPENING FAILS AS PROBE CAN BE ENTERED TO ITS FULL DEPTH OF 100mm ROTATED THROUGH 90° AND CANNOT THEN BE WITHDRAWN



WEDGE TRAP PROBE A

WEDGE TRAP PROBE B

FIG. 5 APPLICATION OF PROBES TO WEDGE TRAPS

entrapment or crushing hazard with other adjacent or newly exposed stationary or moving parts.

For the purposes of these tests it is assumed that a child can sit or lie in position so as to be just clear of the equipment when in motion. Rigidly support the equipment in each of the noted positions in turn. Apply the probes using the procedure described in **C-3.1**.

CAUTION — In the interests of safety, care should be taken to ensure that secure supports are used to keep moving equipment in a position away from its equilibrium position while the tests are carried out.

ANNEX D

(*Clause* 6.2.1)

CHART SHOWING OPENINGS WHICH PASS OR FAIL TESTS

Finger probe enters

| |

yes no —— pass

|

goes in 100 mm

| |

yes no —— fail

|

Presents entrapment or crushing hazard

| |

no yes —— fail

|

|

hand probe enters

| |

yes no —— pass

|

presents entrapment or crushing hazard in entering 165 mm

| |

no yes —— fail

| |

limb probe enters

| |

yes no —— pass

| |

presents entrapment or crushing hazard in entering 700 mm and searching into any reachable position

| |

no yes —— fail

head probe A enters

| |

yes no —— pass

| |

head probe B enters

| |

yes no —— fail

| |

presents entrapment or crushing hazard

| |

no yes —— fail

|

|pass

ANNEX E

(*Clause* 6.2.2)

METHOD FOR DETERMINATION OF CLEARANCE BETWEEN SWING SEATS

E-1 PRINCIPLE

The clearance between user positions on swinging equipment is tested to assess whether the suspension geometry permits swinging positions to collide with each other or with the adjacent structure if the swinging motion, under normal use, deviates from a single arc in a vertical plane.

E-2 APPARATUS

A suitable loading device together with a suitable spring, assorted clamps, hooks, etc and a measuring tape.

E-3 PROCEDURE

Apply a load of not less than 130 kg (*see F1* of Fig. 2) to the swing seat. Measure the length *L*, of the seat in its laden condition.

NOTE — Typical examples of swing seats are shown in Fig. 6.

At a right angle to the place of motion, apply a horizontal load of 13 kg (*see F2* of Fig. 2) to one edge of the sear as close as possible to the surface normally occupied by the user and measure the deflection from the equilibrium position. Repeat the procedure, applying the load in the opposite direction.

E-4 TEST REPORT

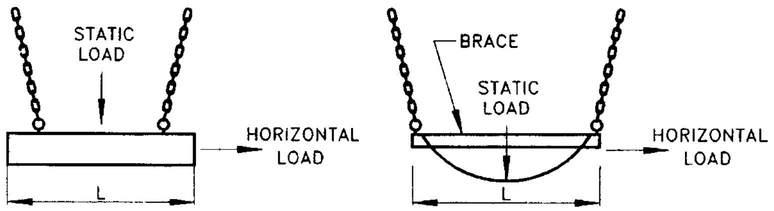
Record and report the following:

a) the deviations *t* from the equilibrium position, in mm;

b) the clearances *s* between adjacent seats or assemblies (side-by-side), in mm;

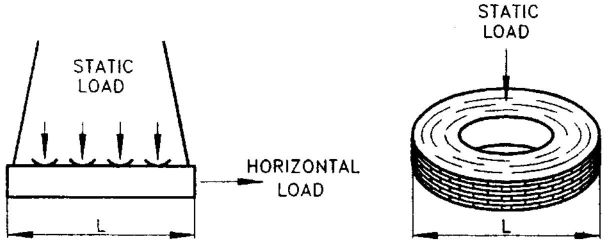
c) the clearance *c* between a seat or seat assembly and the adjacent structure, in mm.

NOTE — Fig. 2 shows measurement positions for *t*, *s*, and *c*.



(a) Rigid Seat

(b) Flexible Seat



(c) Multi Seat

(d) Tyre Seat

FIG. 6 TYPICAL EXAMPLES OF SWINGING SEATS SHOWING THE LENGTH OF SEAT (L)

ANNEX F

(Clause 6.3)

METHODS FOR DETERMINATION OF SWING SEAT IMPACT TEST

F-1 PRINCIPLE

The swing seat impact test assesses whether the weight and construction of the seat is such that the effect of impact on a child in its path of motion is minimized.

F-2 APPARATUS

A typical apparatus shall conform to the following (*see* Fig. 7). The test weight shall be based on a ten pin bowling ball, approximately 216 mm (8.5 in) in diameter. The test weight and its support assembly shall have a mass of 4.77 kg + 0.05 kg. The accelerometer shall be mounted at the centre of gravity of the test weight assembly with the sensitive axis of the accelerometer aligned to within 2° of the direction of travel of the test weight.

The impact shall be between the centre width of the leading edge of the seat under test and the centre of gravity of the test weight. The coefficient of friction between the guide rail and the test weight support assembly shall be not more than 0.02. The pivot point and guidance structure shall be secured so that it remains stationary during the test.

F-3 PROCEDURE

F-3.1 Free Hanging Position of Seat

Allow the seat to assume its free hanging rest position and adjust the relative positions of the seat test weight and guidance system in accordance with the following conditions. Ensure that the centre lines to the test weight and guidance structure, and the impact point of the seat lie in the central plane.

Ensure that the guidance structure is horizontal, with the test weight contacting the impacting surface of the seat. Ensure that the impacting surface of the seat is in line with, and adjacent to, the impact point on the test weight.

NOTE — The impact point is that point on the test weight which lies in the central plane and is at a tangent to the vertical.

F-3.2 Raising Seat for Test

Raise the seat along its arc of travel until the side view projection of a straight line through the pivot point and index mark forms an angle of 60° with the vertical.

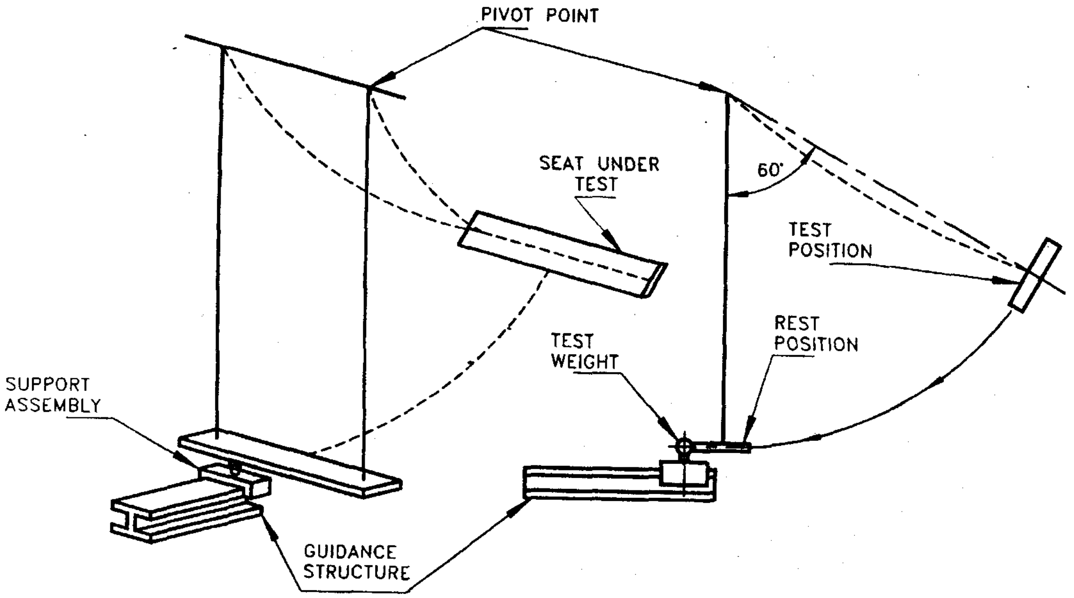


FIG. 7 TYPICAL APPARATUS FOR THE SWING SEAT IMPACT TEST

NOTES

1 When the seat is suspended from ropes or chains, etc, some curvature will be produced in the suspending elements. Adjust the seat position to determine that curvature which provides a stable trajectory.

2 Caution should be exercised to prevent damage to the test equipment. Where there is any possibility of the accelerometer range being exceeded, preliminary tests should be made at lower angles (for example 10°, 20° and 30°). If there is doubt concerning the seat trajectory or stability, the test weight and/or guidance structure trial releases should be made without impacting the test weight.

3 Some seats of a flexible nature will require a brace to maintain the seat configuration during the test procedure. The mass of the brace should not exceed 10 percent of the mass of the seat under test. A typical brace is shown in Fig. 8.

F-3.3 Support and Release of Seat

Support the seat in the raised position by a mechanism that provides release without the application of external forces which would disturb the trajectory of suspending member. Ensure that the seat and suspending elements are motionless. Release the seat so that the assembly travels in a smooth downward arc without any visible oscillation or rotations of the seat which will prevent it from striking the test weight at the impact point.

F-3.4 Collection of Data

Once satisfactory system operation and calibration are obtained, collect data for ten impacts. Measure the peak acceleration for each impact.

F-4 INTERPRETATION OF RESULTS

The seat shall be considered to have passed the test provided there are no peak values of acceleration greater than 50 g.

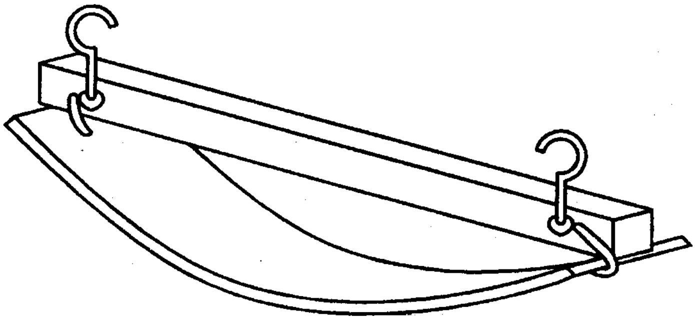


FIG. 8 TYPICAL BRACE FOR FLEXIBLE SEATS

ANNEX G

(*Clause* 6.4)

METHOD OF TEST FOR DYNAMIC LOAD TEST FOR SWING EQUIPMENT

G-1 PRINCIPLE

Load testing of swinging equipment assesses whether the consumable components in the suspension of the system, such as bearings, hooks, eyes and chains, provide an acceptable life before replacement is necessary.

G-2 PROCEDURE

Apply to the seat assembly the test loads of 230 kg on each swing seat and 100 kg to act horizontally at 90° to the cross bar centrally above each seating position. Swing the seat assembly continuously 105 times through an arc of not less than 120°.

NOTE — For safety reasons, weights should be securely attached to the equipment.

G-3 INTERPRETATION OF RESULTS

The consumable components in the suspension system shall be considered to have passed the test provided they show no cracks, permanent deformation or damage and no connection is loosened.

Additionally, there shall be no dimensional change in the components that can be seen with normal vision (aided by glasses or contact lenses where these are normally worn).

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